CONTAINER OVERCAP WITH DRYING AGENT LAYER

FIELD OF THE INVENTION

The present invention relates generally to containers with removable overcaps. More particularly the invention relates to a container overcap with a drying agent layer incorporated into the overcap to absorb moisture from the interior of the container.

BACKGROUND OF THE INVENTION

Containers that store perishable goods, such as food products, often include resealable lids or overcaps so that after the container is first opened, the remaining product can be resealed inside the container. Resealing the container prevents the stored product from exposure to oxygen, moisture, and contaminants from the surrounding atmosphere; however, such oxygen, moisture, and contaminants may enter the interior of the container while the overcap is not connected. Such oxygen, moisture, and contaminants are then sealed into the container when the overcap is replaced. This limited amount of oxygen, moisture, and contaminants can expedite the spoilage of the stored perishable goods. Moisture can also render the product less crisp than may be desired.

To reduce moisture within a container, whether the container is sealed or unsealed, it is well known in the art to include a drying agent in the container to absorb moisture. Silica gel packets are a typical example of a drying agent inserted into a container to absorb moisture. However, such loose packets are not appropriate in every type of container, such as food containers. A loose drying agent could contaminate the stored products or could be accidentally ingested by inattentive consumers.

Therefore a need exists for a drying agent that can be included in a container without possible adverse effects on the stored product or the consumer.

BRIEF SUMMARY OF THE INVENTION

The invention addresses the above needs and achieves other advantages by providing an overcap for sealing an opening of a container and reducing an amount of moisture within the container. The overcap has a top portion with an outside or top surface and an inside or bottom surface such that the overcap covers the opening of the

container with the inside surface of the overcap facing an interior of the container. The overcap also includes a connecting portion extending from the top portion. The connecting portion creates a sealed interface with the container when attached to the container. A drying agent layer is incorporated into the overcap such that it is exposed to moisture within the interior of the container and is operable to absorb moisture from the interior of the container.

In one embodiment of the invention, the drying agent layer is incorporated into the top portion of the overcap below a top layer such that the drying agent layer is directly exposed to the interior of the container. For example, the drying agent layer can be dispersed in a polymer material that forms a bottom layer of the top portion. The overcap can include one or more other layers in addition to the top and bottom layers, and one or more of the other layers can also include drying agent if desired.

In another embodiment of the invention, a layer incorporating a drying agent can be positioned between other layers that do not include a drying agent, such that the drying agent layer is not directly exposed to the interior of the container. In this embodiment, any layer(s) disposed between the drying agent layer and the interior of the container should be formed of a material that is relatively permeable to water vapor so that the drying agent layer can absorb moisture from the container interior. In all embodiments, any layer(s) disposed between the drying agent layer and the outside atmosphere should be relatively impermeable to water vapor so that the drying agent layer absorbs moisture primarily from the interior of the container rather than from the outside atmosphere. Thus, in a preferred embodiment, a barrier layer that is relatively impermeable to water vapor is included in the overcap and is positioned outwardly of the drying agent layer.

Overcaps in accordance with the invention can be formed by various processes. In one embodiment, an overcap is thermoformed from a coextruded sheet. A multilayered sheet is coextruded to include at least two layers, wherein at least one layer incorporates a drying agent. Alternatively, a drying agent layer can be formed separately from the overcap and can then be joined below the top layer of the top portion with an adhesive or the like.

Still another suitable method for creating an overcap is injection molding. A drying agent layer such as a layer incorporating a drying agent may be positioned in a

mold such that injection of a thermoplastic material joins the drying agent layer to the overcap during the subsequent hardening of the overcap. The drying agent layer can form the inside surface of the top portion of the overcap.

The invention thus provides an overcap that incorporates a drying agent layer as an integral part of the overcap to reduce moisture in a sealed container. Because the drying agent layer is an integral part of the overcap, the drying agent is prevented from mixing with the stored product, and direct contact between the drying agent and the stored product is minimized or eliminated. Therefore, the drying agent layer potentially improves the shelf life and/or crispness of the stored product in the container without adversely affecting the quality or use of the stored product.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1 is a perspective view of an overcap, partially in section, in accordance with an embodiment of the present invention;

FIG. 2 is a schematic, cross-sectional view of the overcap of **FIG. 1**, showing a top portion and connecting portion that include a top layer, a barrier layer, and a drying agent layer;

FIG. 3 is a schematic, cross-sectional view of an overcap in accordance with a second embodiment of the present invention, showing a top portion and connecting portion that include a top layer and a drying agent layer;

FIG. 4 is a schematic, cross-sectional view of an overcap in accordance with a third embodiment of the present invention, showing a top portion and connecting portion that include a top layer, a drying agent layer, a polymer layer, and a second drying agent layer; and

FIG. 5 is a schematic, cross-sectional view of an overcap in accordance with a fourth embodiment of the present invention, showing a top portion that includes a top layer, a drying agent layer, and a polymer layer.

DETAILED DESCRIPTION OF THE INVENTION

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the invention are shown. Indeed, the invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

With reference to **FIGS. 1-2**, a sealable storage device in accordance with one embodiment of the invention is illustrated. The storage device **10** includes an overcap **12** and a container **14**. The container **14** is structured to store products within the container and to provide access to the stored products through an opening **16**. Many types of products can be stored in the storage device **10**; however, the storage device is suited to store perishable products because the overcap **12** is resealable such that the stored product is sealed prior to its first use and between subsequent uses.

The container **14**, as illustrated in **FIG. 1**, is a cylindrical tube, such as a paperboard tube. Further embodiments of the invention may include containers **14**, and corresponding overcaps **12**, that are of any geometric shape and/or material. The container **14** of **FIG. 1** is formed by a wall and defines an opening **16**. The opening **16** provides access to an interior of the container and is encircled by a radially outwardly protruding rim **18**. The rim **18** of the illustrated container **14** is an outwardly rolled bead. Other containers **14** of the present invention may include a rim **18** of any configuration, or may lack a rim.

The overcap **12** of **FIG. 1** includes a top portion **20** and a connecting portion **22**. The top portion **20** includes an outside surface **24** that is the top surface of the top portion and an inside surface **26** that is a bottom surface of the top portion. The top portion **20** is structured and arranged to cover the opening **16** of the container such that the inside surface **26** faces an interior of the container **14**. The top portion **20** defines a generally planar surface and may include additional features on the outside surface **24** and the inside surface **26** of the top portion. The top portion **20** also defines a periphery **28** proximate the circumference of the top portion.

The connecting portion **22** of the overcap **12** is structured and arranged to create a sealed interface with the container. The connecting portion **22** extends downward from the periphery **28** of the top portion **20**. The connecting portion **22** of the illustrated storage device **10** is a skirt that includes an inner surface **30** that engages the rim **18** of the container **14** to create a sealed interface. The overcap **12** of further embodiments may include alternative connecting features, and such features may be located at radial distances inside or beyond the periphery **28** or located above the top portion **20**. Such features may include surfaces to facilitate the disconnecting or connecting of the overcap **12** from the container **14**. The connecting portion **22** of the illustrated overcap **12** extends generally perpendicular from the top portion **20** to a distal end **32**. Other embodiments of the overcap **12** may include a connecting portion **22** that extends from the top portion **20** at a non-perpendicular angle.

The top portion **20** of the overcap **12** includes a top layer **34** and a drying agent layer **36** positioned below the top layer such that the drying agent layer is the bottom layer of the top portion. The drying agent layer **36** of the overcap **12** thus defines the inside surface **26** of the top portion **20**. The drying agent layer **36** is exposed to moisture within the interior of the container **14** when the overcap is connected to the container. The drying agent layer **36** of the illustrated overcap includes a polymer material and a drying agent material dispersed in the polymer material. Examples of suitable drying agent materials that can be used include but are not limited to sodium phosphate di-basic, calcium oxide, sucrose, gelatin, bentonite clay, and silica gel. However, other embodiments of the invention may include a drying agent layer **36** of any material that absorbs moisture.

The drying agent layer **36** of the overcap **12** of **FIG. 1** is joined to a barrier layer **38** that is joined to the top layer **34**. The top layer **34** of the overcap **12** may comprise a polymer that is not a particularly good barrier against the passage of water vapor. The barrier layer **38** of the overcap **12** is a barrier material that prevents the passage of moisture (and possibly other substances such as oxygen) into the container **14** and prevents the drying agent layer **36** from being exposed to atmospheric moisture vapor outside the container when the overcap is attached to the container. Therefore, the barrier layer **38** provides an improved barrier to water vapor when compared to the overcap of

FIG. 3, which does not include a barrier layer. The barrier layer **38** of **FIG. 2** can be formed of various materials, which include but are not limited to metal foil, polyethylene terephthalate, metallized polyethylene terephthalate, metal oxide and silicate coated polyester, and mixtures thereof.

The top layer **34** of the illustrated overcap **12** may comprise a polymer material that may also allow some passage of oxygen, which may then pass through the drying agent layer **36** to contact the stored product. The barrier layer **38** may also provide an improved barrier to oxygen when compared to the overcap of **FIG. 3**. In addition to the non-limiting examples of barrier materials listed above, an ethylene vinyl alcohol copolymer material can also be used as the barrier membrane to minimize or prevent the passage of oxygen through the overcap **12**; however, because exposure to moisture degrades the oxygen barrier performance of some ethylene vinyl alcohol copolymer materials, such exposure to moisture should be limited or prevented by the materials surrounding the barrier membrane.

Adhesives or tie layers may be necessary or desirable for joining the barrier layer **38** to the top layer **34**, to the drying agent layer **36**, or to other layers. For example, the barrier layer **38** of **FIGS. 1** and **2** is joined to the drying agent layer **36** by a first tie layer **37** and joined to the top layer **34** by a second tie layer **39**. The tie layers **37** and **39** of the illustrated overcap **12** are adhesive layers; however, tie layers of any material or from any process that suitably join the barrier layer **38** to the adjacent layers may be used.

The overcap **12** of **FIG. 2** includes the drying agent layer **36** in the connecting portion **22**. A segment of the drying agent layer **36** is located between the sealed interface and the distal end **32** of the connecting portion **22**, and that segment is exposed to the atmosphere surrounding the container **14** and may absorb atmospheric moisture. Such absorption of atmospheric moisture may exhaust the moisture absorbing ability of the segment of the drying agent layer **36**. However, such absorbed moisture does not significantly propagate above the sealed interface. Therefore, the absorbed moisture of the segment below the sealed interface has a minimal effect on the moisture absorbing ability of the drying agent layer **36** exposed to the interior of the container **14**.

FIG. 3 depicts an alternative embodiment of an overcap **112** in accordance with the invention. The overcap **112** includes a drying agent layer **36** joined directly to the top

layer **34** of the top portion **20** such that the drying agent layer is the bottom layer of the top portion. In this embodiment, the material of the top layer **34** preferably should have good moisture barrier properties so that the drying agent layer is isolated from atmospheric moisture outside the container through the top portion **20** and the skirt **22**. However, similar to the overcap **12** of **FIG. 2**, the segment of the drying agent layer **36** between the sealed interface and the distal end **32** will be exposed to atmospheric moisture, but the moisture will not significantly propagate above the sealed interface and thus will not exhaust the drying agent layer exposed to the interior of the container **14**.

FIG. 4 also illustrates an overcap **212** with a drying agent layer **36** joined directly to the top layer **34** of the top portion **20**, but in this embodiment the overcap also includes an intermediate polymer layer **40** joined to the drying agent layer and a second drying agent layer **136** joined to the intermediate polymer layer such that the second drying agent layer is the bottom layer, and defines the inside surface **26**, of the top portion. The polymer layer **40** comprises a material that is relatively permeable to water vapor compared to the top layer **34**. The overcap **212** of **FIG. 4** provides additional moisture absorbing ability because moisture absorbed by the second drying agent layer **136** is able to pass through the polymer layer **40** to be further exposed to, and absorbed by, the drying agent layer **36**. The rate of moisture passage through the polymer layer **40** is generally proportionate to the thickness of the polymer layer. Embodiments of overcap **212** having a top layer **34** and a polymer layer **40** of the same material include a polymer layer of less thickness than the top layer. Because the top layer **34** has a thickness greater than the polymer layer **40**, the drying agent layer **36** is exposed to and absorbs relatively more moisture from the interior of the container through the second drying agent layer **136** and the polymer layer than from the atmosphere through the top layer. However, similar to the embodiments of **FIGS. 2** and **3**, the segments of the drying agent layers **36** and **136** of **FIG. 4** below the sealed interface will absorb atmospheric moisture; however, such absorption is preferably limited to that segment such that it has a minimal effect on the drying agent layers above the opening **16** of the container **14**.

FIG. 5 illustrates an overcap **312** with a drying agent layer **36** positioned below the top layer **34** and a polymer layer **40** positioned below the drying agent layer such that the polymer layer is the bottom layer, and defines the inside surface **26**, of the top portion

20. The polymer layer **40** of **FIG. 5** allows passage of moisture so that moisture can be exposed to, and absorbed by, the drying agent layer **36**, with the rate of moisture passage (for a given material) depending upon the thickness of the polymer layer. The polymer layer **40** prevents direct contact between the drying agent layer and the contents of the container, which may be desirable in some cases. The polymer layer **40** can also prevent the drying agent layer from inadvertently being wetted by liquid water, such as when the overcap **312** is detached from the container. The skirt **22** of the overcap **312** of **FIG. 5** does not include the drying agent layer **36** and the polymer layer **40**, but consists only of the top layer **34**. Therefore, the skirt does not include a segment of drying agent layer **36** that is exposed to moisture in the atmosphere surrounding the container **14** as in the overcaps of **FIGS. 2-4**.

The top layer **34** of the illustrated overcaps is a polymer material that is formed into the shape of the overcap through a suitable process such as thermoforming or injection molding. The overcap can be formed of various polymer materials, including but not limited to polypropylene, other polyolefins (including homopolymers, co-polymers, etc.) such as polyethylene, polyester, polystyrene, elastomers (including thermoplastic rubber, thermoplastic elastomer, etc.), and mixtures or combinations thereof.

To manufacture the overcap by a thermoforming process, the individual materials are coextruded into a multilayered sheet. The overcap **12** of **FIG. 1** may be formed from a coextruded sheet with a top layer of polymer material, a middle layer of barrier material, and a bottom layer of drying agent material mixed with a polymer material. After thermoforming and hardening, the polymer material defines the top layer **34**, the barrier material defines the barrier layer **38**, and the drying agent material defines the drying agent layer **36**. Likewise, the overcap **112** of **FIG. 3** may be formed from a coextruded sheet with a top layer of polymer material and a bottom layer of drying agent material mixed with a polymer material. After thermoforming and hardening, the polymer material defines the top layer **34** and the drying agent material defines the drying agent layer **36**.

Furthermore, the overcap **212** of **FIG. 4** may be formed from a coextruded sheet with a top layer of polymer material, an upper middle layer of drying agent material

mixed with a polymer material, a lower middle layer of polymer material, and a bottom layer of drying agent material mixed with a polymer material. After thermoforming and hardening, the polymer material defines the top layer **34**, the drying agent material defines the drying agent layer **36**, the layer of polymer material defines the polymer layer **40**, and the bottom layer of drying agent material defines the second drying agent layer **136**.

Alternatively, to manufacture an overcap, such as the overcap **312** of **FIG. 5**, by an injection molding process, a drying agent layer **36** and polymer layer **40** (which may be pre-adhered together by a suitable tie layer, not shown, or may be coextruded together) are positioned on the bottom surface of the mold. A thermoplastic material is then injected into the mold above and around the drying agent layer **36** such that the material forming the top layer **34** joins the drying agent layer and the material forming the connecting portion **22** encircles the drying agent layer and the polymer layer **40**. After hardening of the thermoplastic material, the resulting overcap **312** is removed from the mold and is ready for connecting to a container **14**. Similar methods are available for the overcaps of further embodiments wherein a single-layer or multiple-layer coextruded sheet is inserted into the mold prior to injection of the thermoplastic material.

A sheet having a drying agent layer **36** (with or without one or more additional layers that can be coextruded with the drying agent layer) may also be joined to the overcap subsequent to the manufacture of the overcap. The sheet may include an adhesive layer on an upper surface of the sheet or the adhesive may be applied to the top layer **34** of the overcap **12** or to the upper surface of the sheet. The sheet is joined to the overcap **12** after the overcap has been manufactured by a suitable manufacturing process. Once the adhesive is either applied or exposed, depending upon the type of adhesive used, the sheet is pressed against the top layer **34** of the overcap **12** such that the adhesive joins the sheet to the top layer. Sufficient time for the adhesive to set or harden should be provided before the overcap **12** is handled in such a way that could impair the adhesion between the overcap and the sheet. Exposure of an overcap to moisture in the atmosphere after it is manufactured and before it is connected to a container **14** should be minimized, regardless of the manufacturing method used, so that the moisture absorbing ability of the drying agent layer **36** is not reduced by the atmospheric moisture.

Overcaps with no drying agent layer in the skirt **22** are preferably manufactured using the injection molding process wherein the drying agent layer is incorporated into the top portion **20** during molding or subsequently joined to the top portion using an adhesive. Overcaps wherein the skirt **22** includes a drying agent layer **36** are preferably manufactured by thermoforming. However, overcaps with a drying agent layer **36** in the skirt **22** can be manufactured other than by thermoforming processes, such as by injection molding as noted above, and overcaps without a drying agent layer in the skirt can be manufactured using a thermoforming process.

The overcap of the present invention reduces moisture in the interior of the container **14** when the overcap is connected to the container to create a sealed interface. Containers in accordance with the invention may include a removable membrane lid that is attached to the top end of the container when the container is filled at the packaging plant. The membrane lid seals the opening of the container such that the drying agent layer **36** is not exposed to the interior of the container prior to the initial opening of the container by a consumer. However, once the membrane lid has been removed to provide access to the stored product, replacement of the overcap allows the drying agent layer **36** to absorb moisture from the interior of the container. This reduction of moisture can delay or prevent the spoilage of some products, and can help maintain crispness of products such as chips, crackers, or the like. Furthermore, the overcap **14** may also include oxygen scavengers to absorb oxygen from the interior of the container. Non-limiting examples of oxygen scavengers include antioxidants such as butylated hydroxyanisole, propyl gallate, and phenylenethiourea.

An overcap that includes a drying agent layer **36** prevents the drying agent from becoming mixed with the stored product and minimizes or eliminates the direct contact between the drying agent and the stored product. Therefore, the drying agent layer **36** can improve the shelf life of the stored product in the storage device **10** without adversely affecting the quality or use of the stored product.

Many modifications and other embodiments of the invention set forth herein will come to mind to one skilled in the art to which the invention pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific

embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.